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Back and forward to the future: an explorative study of public responses to urban groundwater contamination

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The objective of this case study is to explore responses by residents confronted with groundwater contamination in their community. Using a mail-survey design, self-administered questionnaires were collected ($N = 170$) that included questions about risk perceptions, site-specific concerns and perceived neighbourhood problems. The results show that concerns about chemical risks (i.e. chlorinated solvents) are rather limited in comparison to the potential impacts of site-redevelopment and other neighbourhood problems. Accordingly, the results of logistic regression analyses indicate that place detachment is not significantly related to risk perception but rather to site-specific concerns such as a perceived decrease in property values on the one hand, and wider environmental stressors such as traffic congestion on the other. In turn, the latter chronic environmental conditions are closely intertwined with residents' views on the redevelopment of the contaminated site.

Keywords: groundwater contamination; public responses; risk; higher-order impacts

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1. Introduction

Complementing technical research on the environmental impacts and health risks of chemical contamination, in recent decades social scientists have been studying both the cognitive and social determinants of risk perception. While several scholars have pointed at forms of trust in expert systems and the role of knowledge or 'risk-literacy' (see, e.g. Slovic 1987; Savage 1993; Siegrist and Cvetkovich 2000; Slimak and Dietz 2006), it is now also argued that a specific focus on risk perception, whereby primary appraisals of the risk-object are central, might deflect the attention from accompanying, higher-order impacts. Against this background, we not only analyse risk perceptions in this research, but also explore the views on residential choices and site-redevelopment of residents confronted with groundwater contamination in their neighbourhood.

In his well-known study on public responses to groundwater contamination in the Legler section of Jackson Township, New Jersey, Michael Edelstein (2004 (1988)) included a description of different meanings of 'home'. These meanings relate to feelings of safety and place attachment, home as an investment, and home as a place for enjoyment and independence. However, when chemicals pollute residential environments, the meaning of home can convert from a primary source of pleasure and recreation to a cause for fear and dread (Edelstein 2004). In addition to possible health risks and a lost sense of security, chemical contamination can further cause homeowners to question the (perceived) value of their property. The questioning of these investments often also goes

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hand in hand with the feeling of being placed in an everlasting quarantine. Moreover, research on locally unwanted land uses (LULUs) has shown that lower risk perceptions might relate to higher concerns about a decrease in property values (McClelland, Schulze, and Hurd 1990). In other words, one potential way to cope with feelings of confinement is to minimise risk.

Further, the case study in Legler and related work on the psychosocial impacts of residential toxic exposure illuminated the importance of secondary stressors (e.g. Kroll-Smith and Couch 1991; Edelstein 1991; Picou *et al*. 1992; Matthies, Höger, and Guski 2000). These studies have shown that a number of factors, such as hesitant and delayed responses by authorities to manage environmental risks, the development of environmental stigmas (e.g. 'polluted place'), and the victims' distrust of policy makers or policy-making strategies, can cause important negative psychosocial effects in addition to the stress effect of chemical exposure. Accordingly, environmental sociologists have pointed at the stressful nature of 'clashing voices', both vertically and horizontally, over the severity of conservancy, siting and exposure disputes (see, e.g. Freudenburg 1997; Couch and Mercuri 2007; Gunter and Kroll-Smith 2007).

The latter findings closely connect with the concept of the social amplification of risk, which is based on the general idea that "events pertaining to hazards interact with psychological, social, institutional, and cultural processes in ways that can heighten or attenuate perceptions of risk and shape risk behavior" (Kasperson 1992, 157–158). Moreover, these responses may generate higher-order impacts which extend far beyond the direct harms to the environment and people's physical health (Kasperson *et al.* 1988). Next to the secondary stressors as outlined above, these higher-order impacts can further relate to risk remediation techniques and the redevelopment of contaminated land and brownfields (Gross 2010). For example, Vandermoere (2006, 2008) studied the mental health impacts of the process of soil excavation in a contaminated community. While the chosen technique of soil excavation had the benefit of grasping the dangers in an effective manner, it required severe, stress-causing changes in residents' built environment.

Next to risk perception research on the one hand, and studies on the higher-order impacts of environmental risks on the other (Kasperson *et al*. 1988; Kroll-Smith and Couch 1991), a related stream of research has been focusing on residential (dis)satisfaction and environmental annoyances broadly defined (Amerigo and Aragones 1997; Robin, Matheau-Police, and Couty 2007). This includes but is not limited to environmental nuisances such as air pollution, social problems and associated feelings of insecurity, and functional constraints like a lack of public transportation or parking space (see, e.g. Parkes, Kearns, and Atkinson 2002; Hipp 2009). In addition, while social-economic criteria are often central in the study of residential mobility, relatively few studies have examined the relations between residential choice, migration and chronic environmental conditions (Hunter 2005). On the other hand, more often than not, mainstream research within the field of 'risk studies' tends to focus exclusively on 'risk'. As recently noted by Judith Green (2009, 495) this indeed questions the extent to which a risk-framing "preempts the questions we ask and the answers we generate".

Against this background, the case study that follows not only analyses health risk perceptions by residents exposed to groundwater contamination, but also explores potential higher-order impacts such as public concern over the future use of the buildings of the contaminated site. Second, we examine the extent to which both concern over groundwater contamination (i.e. health risk perception), higher-order impacts of chemical contamination (e.g. concern about a decrease of property values), and other neighbourhood problems (e.g. traffic congestion) are associated with people's reconsideration of their

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residential choice. Finally, we investigate how neighbourhood problems which are relatively high on residents' priority lists can serve as an input for the redevelopment of the contaminated site. In the next section, we will first provide a context for the study and describe the methodology.

2. Methodology

2.1. Community context

The study population of this research concerns the inhabitants of the *Toekomstwijk* in the city of Ghent, Belgium. This neighbourhood is located at the *Dampoort*, a dense suburban area in the eastern part of the city. The groundwater contamination in this neighbourhood was caused by the activities of a laundry and dry cleaner in the course of the preceding decennia. Specifically, since the 1950s and 1960s, licenses were given to Flanders Cleaning Services for dry cleaning and cleaning with perchloroethylene (Mava 2010).

In 1995 the Flemish government ratified a decree concerning soil remediation. This decree contains some key issues that led to new ways of handling the contamination. It explains the differences between historical and new soil pollution, and outlines the register of polluted soil and the necessity of a soil certificate in case of conveyance of land property (Vandermoere 2006). Against this background, the former owner of the laundry service ordered a soil research in 1996. The results of this preliminary study and more detailed groundwater surveys since 2000 indicate that the laundry and dry cleaning service caused a widespread contamination with chlorinated solvents. The contamination in the solid part of the earth is mainly situated near the former dry cleaning installations. However, once solvents reached the groundwater table, they dissolved and gradually spread along the groundwater flow, thereby causing groundwater contamination in 200 surrounding parcels (of land) located southwest of the contamination source. Besides the immediate pollution with chlorinated solvents, additional contamination occurred as a consequence of the discharge of polluted wastewater into public sewers. Leakages in the sewer system again aggravated the off-site contamination.

The inhabitants of the *Toekomstwijk* were informed about the pollution by OVAM, the Public Waste Agency of Flanders, since the beginning of the 2000s. Through newsletters and meetings, they also received some recommendations. Although chlorinated solvents such as the dry-cleaning fluid tetrachloroethene did not pose a 'direct' threat to people's health, residents were advised not to use groundwater for drinking, for bathing and showering, and for watering home-grown vegetables. In 2004, some residents started to organise themselves collectively in the form of an action group named *De Vuile Was* (The Dirty Laundry). Petitions and symbolic actions, such as residents hanging out their dirty laundry in a streetscape, asked for the closure of the laundry. These actions were also directed at issues other than groundwater contamination *per se*, such as noise and traffic congestion caused by transport to and from the laundry.

The laundry and dry cleaner Flanders Cleaning Services went bankrupt in 2004. Six years later, its successor Rapid Was O Matic moved all its activities to an industrial area outside the urban area of Ghent (Mava 2010). The site of the former laundry and dry cleaner in the *Toekomstwijk* has been abandoned since 2010. It is currently awaiting remediation and redevelopment, thereby affecting spatial planning processes in the surrounding neighbourhood. As part of a more encompassing policy, OVAM is currently taking measures to clean the groundwater in the contaminated residential area around the site of Flanders Cleaning Services and its successor. Recent lab tests have indicated a

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reduction of chlorinated solvents by adding a carbon source and microbacteria (CityChlor 2011). However, further investigation is needed and at the time of writing this, no final decisions have been made about the remediation technique or about the redevelopment of the site.

The complexity and uncertainty of the situation allow for a broad range of interpretations. For the residents (as well as for other stakeholders, such as local authorities), the consequences of the groundwater pollution remain difficult to pin down. The present and future health risks are difficult to calculate. Moreover, the temporal delay with which the consequences of the environmental contamination may (or may not) manifest themselves adds to the complexity of the situation. In such a context, the residents' actions and reactions will be dependent on their selection and representation of the 'relevant' problems. It will be dependent on the way in which they (re-)imagine their range of options. In the following, we present our analyses of the ways in which the residents of the *Toekomstwijk* currently reduce the complexity of their situation and thereby re-evaluate both past decisions and future risks.

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2.2. Research design

Data for this study were collected by means of mail surveys. The mailing list was obtained by the bureau of population of the local government. The affected community population consisted of 435 adult residents, from which 395 eligible persons received a survey by mail (Response analysis). The data collection strategy was based on the tailored design method (Dillman 1991, 2007). First, a pre-notice letter was sent to the residents. One week later the questionnaires were sent together with a return-addressed stamped envelope and an introductory letter (wave 1). Subsequently, a postcard was sent to all the residents one week after the first wave, thanking them for their co-operation or reminding those who had not yet responded. Finally, a second wave was organised 7 to 10 days after the reminder was sent, once again including the questionnaire together with a return-addressed stamped envelope, thus reminding those residents who had not yet returned the questionnaire (wave 2).

Comparable to the study of Michael Edelstein (2004) on groundwater contamination in Legler, we explored site-specific experiences of the affected population rather than looking for differences with an uncontaminated community as a control group. Further, although this paper focuses on quantitative data, we drew on local print media and newsletters, and held unstructured conversations with stakeholders to explore the history of the site. In addition, qualitative interviews with the residents were used as a preliminary research to design the survey. Next to the inclusion of variables discussed in the aforementioned scholarly literature, these interviews were used to provide input for the insertion of the site-specific items in our survey instrument. As such, we believe that we have been able to provide a nuanced picture of the concerns of the inhabitants of the *Toekomstwijk*.

2.3. Measures

Risk perception was measured by using three items. A distinction was made between risks for oneself, risks for children, and risks for other community residents. Scores ranged from 1 (very low) to 5 (very high). The score shows an adequate internal consistency ($\alpha = 0.951$).

Next to measuring risk perception, we also measured people's reconsideration of their residential choice by means of the following item: "Suppose you could reconsider your residential choice: would you decide to live here again? (yes/no)".

Site-specific concerns were measured by using three items. During the interviews with the residents three major concerns were repeatedly raised: concern about a decrease of property values, the time required for decontaminating the groundwater, and concern about the future use of the buildings and location of the former laundry and dry cleaner. Scores ranged from 1 (never) to 5 (very often: $\alpha = 0.653$).

Perceived neighbourhood problems were based on the major concerns registered during the interviews of the qualitative part of this study. Based on 15 interviews with the residents, five major neighbourhood problems were registered: traffic congestion, air pollution, cyclists' safety, litter and illegal dumping, and shortage of parking. Next, a structured questionnaire measured the extent to which inhabitants were concerned about these problems, with answers ranging from 1 (never) to 5 (very often: $\alpha = 0.686$).

In addition to local concerns, residents could mention their preferences regarding the redevelopment of the site (open-ended question). Finally, the proximity of people's homes to the former laundry and dry cleaner was measured by a dummy variable (with 1 referring to those dwellings located in the streets that immediately surround the laundry).

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2.4. Response analysis

Based on the research design as outlined above, we gathered data from 170 residents out of 395 eligible persons. First, eligibility was based on the variables 'age' and 'exposure' (i.e. adults who live in the contaminated area). Further, we personally contacted the households which consisted of three or more domiciled individuals, in order to be able to partially exclude those residents who were domiciled at the address but who were not actual residents. As such, the number of eligible persons could be refined (from 435 to 395), indicating an overall response rate of 43% (= 170/395). Of the returned questionnaires, 97.1% were 'complete', i.e. questionnaires wherein 80% or more of the applicable questions were answered. Almost half of the questionnaires (44.1%) were returned during the first week, 28.2% during the second week, and 18.2% three weeks after the beginning of the first wave. Given that only a limited number of questionnaires were sent back during the fourth and fifth week (12 and 4 questionnaires respectively), one can expect the marginal increase of a third wave to have been low.

2.5. Sample characteristics

There are slightly more women than men in our sample (57.7% women). The average age is 43 years, ranging from 18 to 84 years old. Approximately one-third of the respondents have children aged 12 years or less (35.5%). The education level ranges from secondary education or less (34.3%) to higher non-university education (35.5%) and university education (30.1%). The average duration of residence is 13 years, ranging from 1 to 46 years. A majority of the respondents are homeowners (82.9%), 17.1% of the residents in our sample are tenants. The ratio of homeowners/tenants in our sample is quite similar to the population in the *Toekomstwijk*, with comparable ratios of 17 to 83% and 22 to 78%, respectively. For privacy reasons, we could not gain access to detailed population data at the community level, but, as far as we are able to ascertain, the sample is roughly representative of the community area under study.

3. Results

In what follows, we first discuss the descriptive statistics and partial correlations with a focus on residents' risk perceptions. Next, additional independent *t*-tests (i.e. comparisons of mean-values) are reported in order to further clarify differences within the population. Subsequently, binary logistic regression analyses are used to examine people's reconsideration of their residential choice (back to the future). Finally, we report the exploratory findings on residents' views on site redevelopment and their connections to perceived neighbourhood problems (looking to the future).

First, considering the mean value of risk perception ($M = 8.41$; sd $= 2.95$), given that the scale ranged from 3 to 15, and knowing that two-thirds of the respondents scored 9 or less (100/146 or 68.5%), it is clear that the overall risk perceptions are rather low to moderate. The moderate to low average scores of health risk perception relate to the fact that only a minority of the community residents make actual use of groundwater. In addition, other local concerns were of greater importance to many residents. For example, many people pointed at the lack of parking space in their community, as well as litter or illegal dumping, and road traffic congestion. As shown in Figure 1, the latter problems were higher on many people's local priority lists than the groundwater contamination.

Further, as shown in Table 1, residential status is unrelated to risk perception, yet it is significantly associated both with site-specific concerns and perceptions of neighbourhood problems. Specifically, being a homeowner is positively correlated with site-specific concerns such as a decrease in property values and with concern about other neighbourhood problems such as litter and illegal dumping (with r's $= 0.267$ and 0.190). Similarly, the presence of children in the household relates positively to site-specific concerns and perceived neighbourhood problems but not with risk perception. Although some prudence is needed in the interpretation of this finding, it seems to indicate that parents perceive having relatively more control over the potential health risks of groundwater contamination, both for themselves and for their children, than over other community issues such as local traffic congestion and related problems such as air pollution.

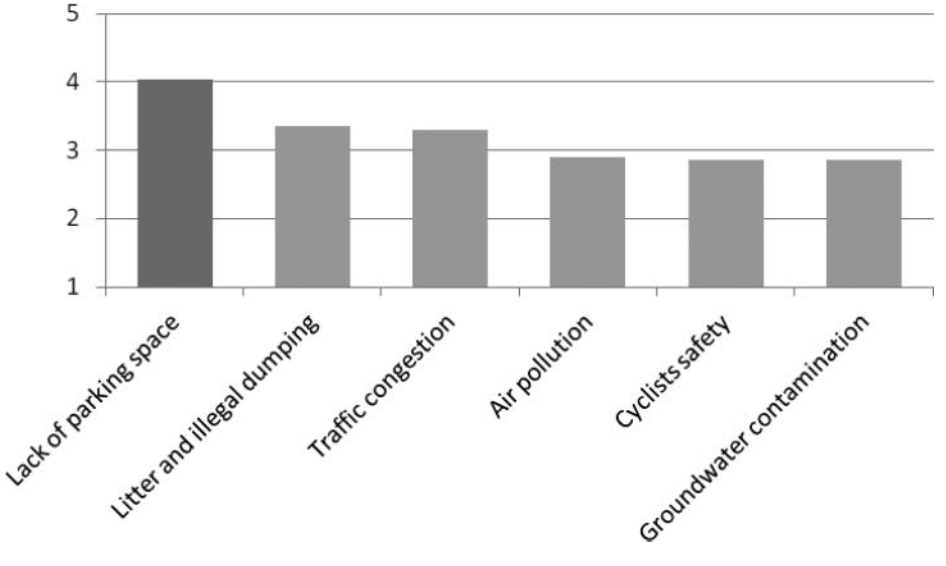

Figure 1. Perceived neighbourhood problems (mean values).

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Table 1. Descriptive statistics and partial correlation matrix.

	M	SD	(min; max)	1	2	3	4	5	6
1	8.41	2.95	(3; 15)	1.00					
2	7.94	2.61	(3; 15)	0.29***	1.00				
3	16.43	4.18	(6; 25)	0.043	0.309***	1.00			
4	1.83	0.38	(1; 2)	−0.104	0.267**	0.190*	1.00		
5	12.85	10.81	(1; 46)	−0.234**	0.008	−0.110	0.317***	1.00	
6	1.36	0.48	(1; 2)	0.040	0.317***	0.246**	0.310***	−0.082	1.00

Notes: Cases pairwise excluded, *N* range 136–158. 1 = risk perception; 2 = site-specific concerns; 3 = perceived neighbourhood problems; 4 = residential status; 5 = duration of residence; 6 = presence of children. Partial correlations controlled for the social-demographics gender, age and education. $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

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Risk perception associates significantly with duration of residence ($r = -0.234$, $p < 0.01$). In particular, the negative correlation suggests that the longer that people live in their community, the more likely it seems that they consider themselves to have built up a kind of immunity or habituation system. For example, during the initial qualitative interviews some of these relatively older residents often wondered: "We have been living in this neighbourhood for more than 20 years, so why would our groundwater suddenly be problematic?" One-way ANOVAs further indicated that differences in risk perception did not vary significantly with gender, age and educational background (with $F_{gender} = 0.14$, $p = 0.71$; $F_{age} = 1.94$, $p = 0.15$; and $F_{education} = 0.68$, $p = 0.51$). In addition, Pearson correlations with the items of the composite variable 'site-specific concerns' analysed separately, indicated that risk perception associates positively rather than negatively (McClelland, Schulze, and Hurd 1990), with concern about property values ($r = 0.26$, $p < 0.01$).

Additional *t*-tests revealed that, on average, homeowners experience greater concern about potential decreases in property values ($M = 2.59$) than tenants ($M = 1.56$). This difference was significant at $p < 0.001$ ($t(158) = -4.434$). The same applies to concerns about the time required for decontaminating the groundwater, thus with homeowners, on average, being more concerned than tenants ($M_{owners} = 2.65$, $M_{tenants} = 2.04$, $t(156) = -2.756$, $p < 0.01$). Furthermore, analyses in which we used concern about the future use of the former location of the laundry as a test variable revealed the importance of residents' geographical location. In particular, on average, those residents who live close to the former laundry express greater concern about its future use than people living further away ($M_{distant} = 2.80$, $M_{close} = 3.24$, $t(163) = -2.030$, $p < 0.05$; $r = 0.157$, $p < 0.05$). The residents who live close to the former dry cleaner thus want to avoid any additional sub-local problems.

As noted above, next to risk perception, we included a more indirect indicator, which could be termed a 'back to the future' measure of risk perception and its connection to risk aversive behaviour. Specifically, in order to measure people's reconsideration of their residential choice, we posed the question: "Suppose you could reconsider your residential choice. Would you then decide to live here again? (yes/no)". The descriptive statistics indicate that 30.9% of respondents would reconsider their residential choice, whereas approximately two-thirds of the residents would stay, thus not reconsidering their initial residential choice (114/165).

The results of logistic regression analyses further reveal that residential status, duration of residence, and presence of children is not significantly related to people's intention to reconsider their residential choice (Table 2, step 1). In a second step, it is also shown

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Table 2. Determinants of residential choice.

	S1		S2		S3		S4		S5	
	B / sig. (SE)	Exp (B)	B / sig. (SE)	Exp (B)	B / sig. (SE)	Exp (B)	B / sig. (SE)	Exp (B)	B / sig. (SE)	Exp (B)
Residential status (ref. cat: owner)	−0.35 (0.58)	0.70								
Duration of residence	0.01 (0.03)	1.01								
Presence of children (ref. cat: 'yes')	−0.28 (0.45)	0.75								
Risk perception			sig.: 0.27				sig.: 0.42			
Low vs. high			−0.60 (0.49)	0.55			−0.45 (0.52)	0.64		
Moderate vs. high			0.16 (0.48)	1.17			0.23 (0.51)	1.25		
Site-specific concerns					sig.: 0.04		sig.: 0.04		sig.: 0.26	
Low vs. high					−1.03* (0.48)	0.36	−1.17* (0.56)	0.31	−0.80 (0.55)	0.45
Moderate vs. high					−0.93* (0.45)	0.39	−0.96* (0.48)	0.38	−0.58 (0.48)	0.56
Perceived neighbourhood problems									sig.: 0.014	
Low vs. high									−1.62** (0.56)	0.20
Moderate vs. high									−0.66 (0.48)	0.52
Constant	−0.92 (0.76)	.40	−0.49 (0.55)	0.61	−0.21 (0.46)	.81	0.08 (0.59)	1.08	0.26 (0.52)	1.30
Pseudo R-Square (Nagelkerke) / N	14.7% / N = 154		17.3% / N = 139		19.8% / N = 155		25.3% / N = 138		28.1% / N = 147	

Notes: Binary logistic regression analyses, controlled for gender, age and education. *$p < 0.05$, **$p < 0.01$.

that this intention is not significantly related to risk perception. Moreover, in the following two steps, it is shown that people's concerns, such as those relating to the redevelopment of the site or the potential decrease of property values and thus not residents' risk perceptions, relate significantly to people's intention to reconsider their residential choice. Specifically, the results in Table 2 show that respondents with high scores on site-specific concerns are more than three times as likely (relative to low scores) to reconsider their residential choice (1/0.31 = 3.23, step 4). In a fifth step, however, it is shown that the effect of these site-specific concerns disappears once concern about other neighbourhood problems such as shortage of parking are included in the model. For people with high levels of concern about neighbourhood problems, relative to low levels, the odds ratio of reconsidering residential choice is expected to increase by a factor of 5 (1/0.20).

In addition to neighbourhood problems, residents were able to state their preferences regarding the redevelopment of the site. In particular, participants were asked: "What would you like to see happen in the future with the location of the former laundry and dry cleaner?". Subsequently, respondents' preferences were coded in the following categories: social-cultural (e.g. social-artistic space), green space (e.g. urban gardens), commercial (e.g. shops), residential (housing), and parking space. Approximately two-thirds of the people in our sample responded to this question (i.e. 115/170 or 67.6%). As they were allowed to mention more than one preference, 167 preferences were given by 115 residents. The results shown in Figure 2 illustrate that a majority of these residents asked for more green space and more parking space (45.2% and 38.3%, respectively), followed by social-cultural and residential projects (20% and 17.4% respectively).

Further, it is noteworthy that, despite the fact that we asked people to mention their preferences regarding the redevelopment of the site (positive choices), several residents (20/115) indicated what they would definitely not like to see happen in the future. These

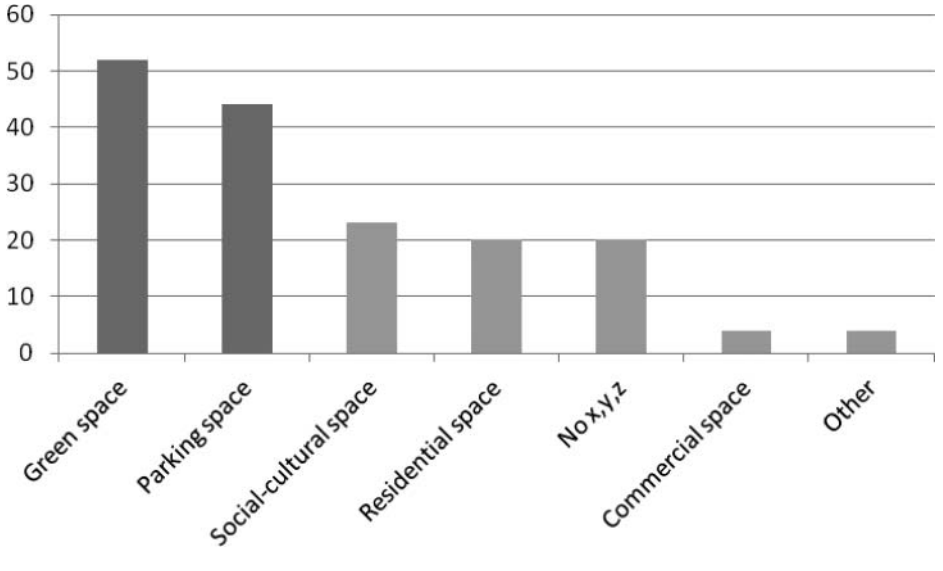

Figure 2. Residents' preferences regarding site-redevelopment (absolute frequencies).

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'negative' choices mainly referred to those uses that, in the view of these residents, might lead to a larger deficiency of parking space or to an increase in traffic congestion. The latter mainly referred to the potential nuisance caused by new industrial and commercial activities on the one hand, and to residential projects on the other. A few residents further expressed their aversion to social housing and the environmental stressors they perceived to be associated with lower social-economic status, such as litter and illegal dumping. In addition, while many people were not reluctant about the building of new single-family dwellings (as long as they would not be sold or rented too cheaply), some residents feared the consequences of constructing an apartment building in the already densely populated neighbourhood of the *Toekomstwijk*.

In addition, it is quite remarkable that, from the 115 residents who replied to the open-ended question on site-redevelopment, more than two-thirds of them (70.4%) asked for more green and/or parking space. Although in principle parking space might tackle the problem of shortage of parking in the community, the potential of additional parking space was often mentioned under the condition that it would remain local (i.e. for residents' use only), and that it would not create additional problems such as noise and traffic congestion. A park seems to be the most preferred option both because of what it could provide (i.e. an additional social meeting space for residents) but also because of what it could prevent (i.e. environmental stressors related to alternative options, see Figure 1).

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4. Conclusion

In this paper we reported findings from a mail survey in which public responses to urban groundwater contamination were explored. The analyses first showed that groundwater contamination itself caused less stress or anxiety than other problems (mostly unrelated to the environmental pollution itself). Low to moderate concerns about the health risks of groundwater contamination are related to the fact that only a minority of the community residents make actual use of groundwater. As the main potential exposure route requires the use of groundwater, residents felt able to control the exposure route and the resulting health risks, despite the fact that many people recognised the presence of hazards. In other words, the impact of the contamination on people's everyday practices was limited and, if nonetheless applicable, in the residents' view it remained under their own control (e.g. by using rainwater for gardening).

Nevertheless, several residents were concerned about a decrease of property values, the time required for decontaminating the groundwater, and the future use of the location of the former laundry. This is in accordance with previous research indicating that stressors related to the recovery and the redevelopment of a contaminated site can be more critical than the threat of the contamination itself (Kroll-Smith and Couch 1991; Picou *et al.* 1992; Matthies, Höger, and Guski 2000; Vandermoere 2006). This is also consistent with previous research on the social amplification of risk, which has emphasised the role of rippling effects (Kasperson *et al.* 1988; Kasperson 1992). This case study further adds that concern about higher-order impacts of chemical contamination, such as a decrease in property values or the future use of the former location of the laundry, may vary according to geographical location (i.e. proximity to the contamination source) as well as to social-economic characteristics such as residential status (i.e. the importance of ownership) and household composition (i.e. the position of families with younger children in this neighbourhood).

In other respects, the findings of our study contrast with previous research. For example, different from studies on locally unwanted land uses (McClelland, Schulze, and Hurd 1990), risk perception associated positively rather than negatively with concern about property values. One potential explanation is that, although minimising risk might provide a strategy to cope with feelings of confinement in the short run (i.e. to prevent further stigmatisation and a decrease in property values), in our study, homeowners seem to have evaluated being better off financially in the long run, once their groundwater is decontaminated. In addition, it is noteworthy that the variables of gender, age and education were of minor importance in this case study. This differs from previous large-scale surveys which suggested that women, younger people and lower educated persons are more likely to develop higher risk perceptions (see, e.g. Savage 1993). It appears that demographics become less explanatory once risk perception models at the population level are studied in local contexts, confronted with specific social and environmental conditions and specific 'real-world' risks.

Whether or not this last 'methodological' point turns out to be applicable, our case study clearly indicates that it is important to discuss risk perceptions in relation to other neighbourhood problems, as smaller pieces of a bigger picture as it were. In our study, insights into community problems provided a new contextual layer to interpret low to moderate perceived risks in terms of residents' local priority lists. In addition, the results showed that people's reconsideration of their residential choice – which might be considered as a proxy for place detachment – did not relate to risk perception but rather to chronic environmental conditions such as traffic congestion. Moreover, it was shown that these environmental stressors might also help us to understand how people develop their views on the redevelopment of the contaminated site. They constitute important motives that help residents control the complexity of the situation in which they (largely unexpectedly) find themselves.

In this study significant efforts were made to stimulate residents' participation in the survey research. However, it should be noted that the sample size of this study was relatively small and that some site-specific measures were short scales. Notwithstanding that the items of site-specific variables were based on the initial qualitative interviews, the disadvantages of measuring the site-specific variables by short scales should be acknowledged in terms of limited information on reliability and validity. Further, in order to generalise our interpretations it would be useful to compare these findings with other case studies. Another limitation of the present study concerns the cross-sectional nature of our data. In line with the social amplification of risk framework, future research with multiple measurement moments can pay more attention to how residents, community groups and other stakeholders can function both as stations of risk amplification and attenuation. Next to methods of social network analysis, longitudinal qualitative research designs can be used for analysing change through time.

Finally, we believe that it is worthwhile to analyse how representations of the past and the future affect the present concerns of residents. The increasing saliency of potential hazards or risks in the modern 'risk society' is not just a consequence of the increase of technological interventions in our environment. The perception of risks (as well as the perception of the increase of risks) also depends on the social and cognitive frames upon which people rely in order to deal with the conditions of life in modern society. Seen from this perspective, it is of particular relevance for the social sciences to complement the more technical research on the environmental impacts and health risks of specific environmental contaminations by means of research that primarily focuses on the motives

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which become relevant under particular circumstances, and which are used by residents and other stakeholders to reduce the complexity of their situation, to reconsider past decisions and to give relevance to the future.

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